

DIDYMOCARPUS CORCHORIFOLIUS AND ITS ALLIES (GESNERIACEAE)

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SUMMARY

Didymocarpus sect. *Elati* Ridley, later reduced by its author to sect. *Didymocarpus*, is redefined and reinstated for the accommodation of 4 or 5 morphologically distinctive Malayan species: *D. corchorifolius* DC. (Pulau Penang, S. Thailand), *D. antirrhinoides* A. Weber, sp. nov. (confused under the former by Ridley; widely distributed on the Malay Peninsula), *D. sp.* (not yet adequately known; Pulau Tioman), *D. sulphureus* Ridley (on some hills of the main range), and *D. robustus* Ridley (endemic on G. Kerbau). Essential characters are tall, woody habit, bilobed stigma, and conoid pigmented glands. The species that have been associated with the above are surveyed. It is concluded that, with the exception of *D. citrinus* Ridley which seems to form a link from sect. *Didymocarpus* to sect. *Elati*, none is closely allied.

INTRODUCTION

In 1905 Ridley established the section *Elati* within *Didymocarpus* for the accommodation of four Malayan species, *D. corchorifolius* DC., *D. sulphureus* Ridley, *D. citrinus* Ridley, and *D. purpureus* Ridley. In his 'Flora of the Malay Peninsula' (1923), however, he did not refer to this section and placed these species without comment in sect. *Didymocarpus* ('*Eudidymocarpus*').

The need to re-appraise this decision arose from observations made by the first author when collecting on the Malay Peninsula in 1979. Two of the collected gesneriads, which proved to fall into Ridley's concept of *D. corchorifolius* and *D. sulphureus* respectively, showed characters that were clearly anomalous in *Didymocarpus*: both were tall and woody plants and both had bilobed stigmas, suggesting that, even if they were correctly referred to that genus, they could scarcely be placed in the typical section. Further investigations were therefore begun.

First it became clear that the collected '*D. corchorifolius*' was not conspecific with that described by DeCandolle (1845), and that Ridley had confused two distinct species under that name. The 'true' *D. corchorifolius*, from Pulau Penang, has free bracts and calyx divided to the base. The mainland plants, however, have bracts partially united on one side and a cupular calyx with sepals fused to midway. This is

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the species on which Ridley based his descriptions of *D. corchorifolius*. It is named *D. antirrhinoides* A. Weber below, in reference to the personate, 'Antirrhinum'-like corolla (although this feature is most probably shared with *D. corchorifolius*). In addition, there may well be a third species in this group, on Pulau Tioman, but the available material is inadequate for naming and it is enumerated here as *D. sp.*

From this alliance *D. sulphureus* and its close ally *D. robustus* differ markedly in habit, in the drooping inflorescences, and the yellow, trumpet-shaped corollas. Despite these striking differences there are, however, good reasons for keeping them in the same group.

We here present the characters of this group and use them to justify the revival of sect. *Elati* Ridley. We also survey briefly the other species which have been included in this section or in sect. *Didymocarpus* by Ridley, concluding that none of them belongs to the redefined *Elati*.

CHARACTERS OF SECTION ELATI AND OTHER SECTIONS

When establishing sect. *Elati* Ridley (1905) quoted the following characters: "stem tall, branched, shrubby, leaves in distant pairs, opposite unequal". This characterization is rather meagre and Ridley actually contradicted himself when including *D. citrinus*, which is in his own words a "soft, weak herb, about a foot tall" and *D. purpureus*, described as "herbaceous, weak".

As mentioned above, Ridley later dispensed with this section and included its species in sect. *Didymocarpus*. We do not, however, agree with this decision and revive sect. *Elati* for three or four species allied to *D. corchorifolius*, which is the lectotype of the section (Burt, 1954: 204). These species fall into two groups which can be associated with the oldest names, the *D. corchorifolius*-group (spp. 1–3) and the *D. sulphureus*-group (spp. 4 and 5):

<i>D. corchorifolius</i> -group	<i>D. sulphureus</i> -group
Stem erect	Axes ascending, climbing, and straggling
Peduncles short, straight, and stiff	Peduncles much elongated, flexuous, pendulous (fig. 7)
Corolla tube broad throughout, closed at the mouth where the raised palate presses against the base of the upper lip (personate, fig. 6 a, b), whitish	Corolla infundibuliform, narrowed below, open at the mouth, bright yellow

In view of the conspicuous differences the relationship of the two groups is not evident at first sight. There are, however, good characters that serve to link them:

1. Tall stature (1.5–2.5 m) and woody axes
2. \pm well marked anisophylly
3. Pigmented glands with elongate head-cell on vegetative and some floral parts
4. Polished cartilaginous texture of subcordate bracts and sepals
5. Anthers with swollen or lobed connective at head of filament
6. Same type of bilobed stigma
7. Fruit dehiscent loculicidally along both sutures
8. Tuberculate seeds
9. Common chromosome base number ($x = 11$)

Of these characters, most of which are discussed in detail below, habit (1, 2), form of pigmented glands (3), enlarged anther connective (5), stigma (6) and (to some extent) seed-coat (8) serve to distinguish sect. *Elati* from all other sections and specially from sect. *Didymocarpus*. The same holds true for the chromosome base number $x = 11$, unknown elsewhere in the genus except in *D. citrinus*, which is to be placed in sect. *Didymocarpus*, but comes close to sect. *Elati* in several characters (see below). Other characters such as those of bracts and calyx (4), fruit dehiscence (7), and the presence of pigmented glands (although different in shape!) link sect. *Elati* to sect. *Didymocarpus* and set them apart from the other sections of the genus, to which most of the Malesian species belong.

Sect. *Didymocarpus* is centred in the eastern Himalayas, S. China, and Thailand, reaching with two or three species (*D. purpureus*, on Pulau Langkawi, *D. citrinus*, on Kedah Peak, and *D. violaceus*, if belonging to this section) the northern part of the Malay Peninsula. The plants are herbaceous, perennial, and adapted to a seasonal or temperate climate. Most species develop annual stems a few dm high, bearing some leaf pairs with axillary inflorescences near the top. Not infrequently coloured glands are found, especially on the lower surface of the leaves (see below). The tubular flowers are often wine-red and shining. The fruit stands straight in the calyx (in direct continuation of the pedicel) and dehisces along both sutures.

In the other sections the fruit is usually held horizontally (fruit making an angle with the pedicel) and dehisces only (at least first) along the upper suture; the bracts and sepals are never thick and polished in texture, the bracts are not subcordate, and there are never pigmented glands present. In fact, it is only in the elaboration of the connective into a swollen pad, with or without free lobes, that sect. *Elati* shows an approach to the other Malesian sections of the genus.

Thus *Didymocarpus* sect. *Elati*, as redefined here, stands as a small distinctive group which may be taken as the tropical counterpart of the generally more temperate section *Didymocarpus*. However, it must be pointed out that the boundary between the two sections is not absolutely clear-cut. It is *D. citrinus* that forms a link as it shares some characters with *D. sulphureus* (see below).

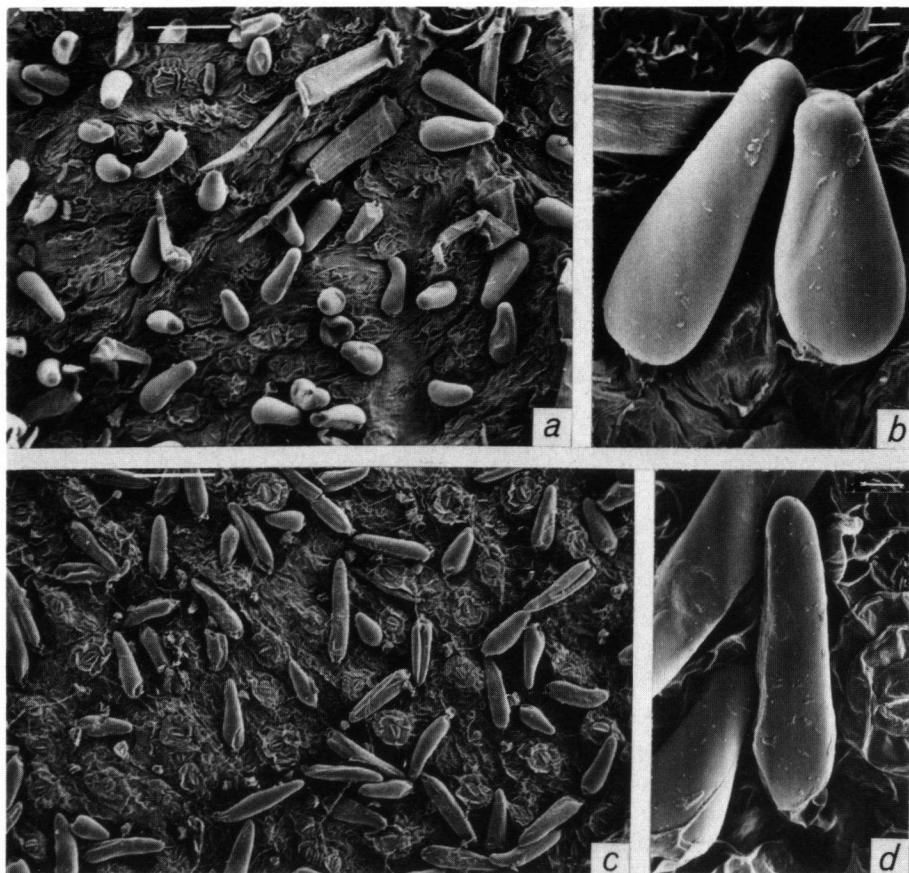


Fig. 1. SEM-micrographs of glands on leaf underside. — a, b. *Didymocarpus antirrhinoides* (type). — c, d. *D. sulphureus* (Vogel & Weber 790819-1/1, WU). Bar 100 μm .

NOTES ON SOME CHARACTERS

Habit. — In contrast to other *Didymocarpi*, especially of sect. *Didymocarpus*, the species of sect. *Elati* are characterized by their large size, associated with the \pm strong lignification of the axes. In addition, *D. corchorifolius* and *D. sulphureus* are conspicuous by the marked anisophylly, the major leaf of a pair (plus-leaf) being often more than twice as long as the smaller one (minus-leaf). Anisophylly is less marked in *D. antirrhinoides* and rather inconspicuous in *D. robustus*, in which the leaves are whorled.

Besides, *D. corchorifolius* is usually distinctive by the development of short, densely leaved shoots (brachyblasts) emerging from the leaf axils nearly throughout the

flowering region (fig. 4). They occur as serial shoots shortly after the production of the axillary inflorescence and bear inflorescences themselves. In principle, the same holds true for *D. antirrhinoides*, but the development of such shoots is much delayed so that the upper part of the flowering region is without them. The pattern of *D. corchorifolius* is even more strongly developed in the doubtful species listed as *D. sp.* below. Here the leaves of the main axis apparently fall very soon and are functionally replaced by brachyblasts with small, densely crowded leaves.

Pigmented glands. — All species of sect. *Elati* have very characteristic cone- to spindle-shaped, pigmented glands on the axes, the lower surface of the leaves and some floral parts (ovary, fruit). Those of *D. antirrhinoides* (fig. 1a, b), *D. corchorifolius* and *D. sp.* are relatively short and somewhat broader at the base, those of *D. sulphureus* (fig. 1c, d) and *D. robustus* are more rod-like. The whole gland consists of two cells: a short stalk-cell with thin wall and the elongate head-cell with robust and coloured surface. The colour range is from light yellowish brown through rusty brown (especially *D. sulphureus*) to blackish-red.

Despite special studies on the trichomes of Gesneriaceae (Rechinger, 1899; Pongráčí, 1931; Sahasrabudhe & Stace, 1977) this gland type has not been described up to now. However, pigmented glands have long been known in Gesneriaceae and have attracted the attention of chemists. In *Streptocarpus* they are found in *S. dunnii*, producing the naphthaquinone 'dunnione' (Price & Robinson, 1938, 1940), in *S. pole-evansii*, and *S. denticulatus*, producing a chalcone quinone in the last (Hilliard & Burtt, 1971: 67). In *Didymocarpus* aurentiacin and some benzoquinoid chalcones have been reported as gland exudates of *D. aurentiacus* and *D. pedicellatus*, respectively. Recently Wollenweber, Rehse & Dietz (1981, which see also for references to earlier work) have found the chalcone flavokawin B in the glands of *D. antirrhinoides* (under the name *D. corchorifolius*).

A rapid survey in the Edinburgh herbarium showed that of the 32 species of *Didymocarpus* sect. *Didymocarpus* represented 19 were without and 13 with glands. Perhaps commonest are glands with a single spherical head cell (fig. 2a) (mostly with thin wall and therefore usually deformed or collapsed in the herbarium specimens). The glands of *D. citrinus* have very distinctive twin head-cells (fig. 2b), *D. rodergi* has glands with a disc-like multicellular head (fig. 2c) and those of *D. insulsus* (fig. 2d, e) and *D. tristis* have four head-cells arranged in the form of a cross. The precise conoidal or rod-shaped glands found in sect. *Elati* are restricted to that section.

Anther appendages. — At the junction of anther and filament in *D. sulphureus* the connective is swollen to form a thick pad. In *D. antirrhinoides* this is further developed, having two free \pm triangular lobes (fig. 6f). This sort of elaboration of the connective is not uncommon in sect. *Heteroboaea*, but is not known to occur in sect. *Didymocarpus* (except in *D. citrinus*), where the anthers may sometimes be bearded.

Stigma. — Typically, the stigma in *Didymocarpus* is relatively small, capitate and undivided. In sect. *Elati* it has, however, two distinct lobes, an upper and a lower one, the latter being distinctly larger (fig. 6g-i). The statement that the stigma is bilobed must not be allowed to cause confusion with a distinctive generic feature of *Chirita* that serves to keep it separate from *Didymocarpus*: in *Chirita* it is the lower

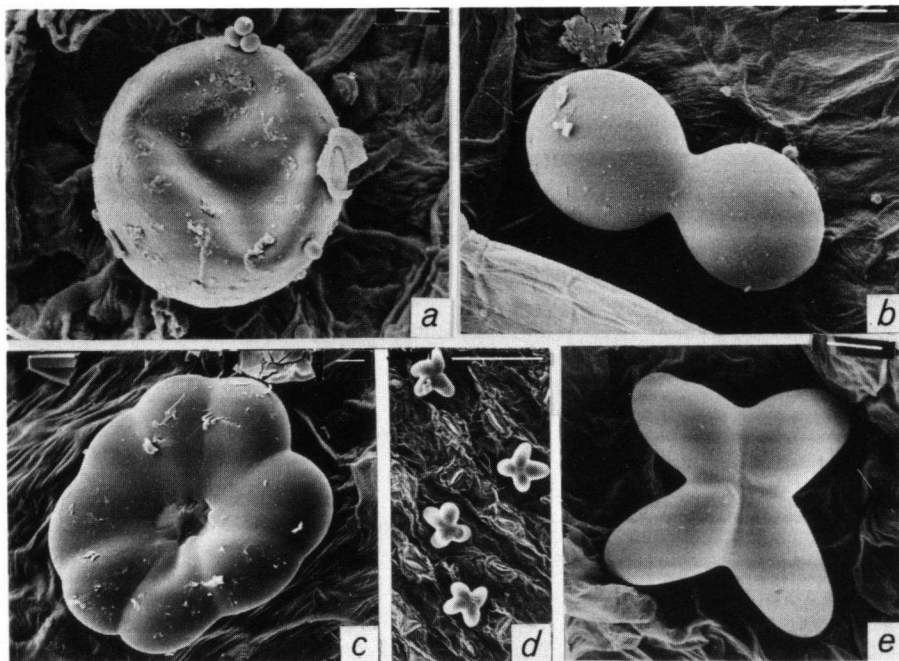


Fig. 2. SEM-micrographs of different gland forms in *Didymocarpus*. — a. *D. hookeri* (Koelz 23119, E). — b. *D. citrinus* (Ridley 5518, BM). — c. *D. rodgeri* var. *siamensis* (cult. E sub no. C 5940 from Burt 5606). — d, e. *D. insulsus* (cult. E sub no. C 4304 from Smitinand 7558). Bar 100 μm.

lip of the stigma that is divided, the lobes lying in the same horizontal plane; the upper lip is usually aborted.

Seeds. — The seeds of sect. *Elati* are very characteristic by the tuberculate surface (cf. fig. 3a, b). The testa cells are rectangular or polygonal, being somewhat prolonged in the direction of the seed's long axis. The tubercles arise from the middle of the cells. As the testa cells become shorter and smaller toward both ends of the seed, the tubercles stand more crowded there.

The side walls of the testa cells are thickened and an additional strongly thickened band runs through the middle of the surface wall. It is this band which, with thinner tissue on either side, grows up in the middle of the cell to form a steep tubercle with a rounded top (fig. 3c, d).

A survey of about 30 species of *Didymocarpus* (carried out both with light microscope and SEM) revealed that this type of seed is not strictly confined to sect. *Elati*. It also occurs in *D. cordatus* and, especially in less developed form, in some species of sect. *Didymocarpus* (but not in other sections!). Without going into detail here (a

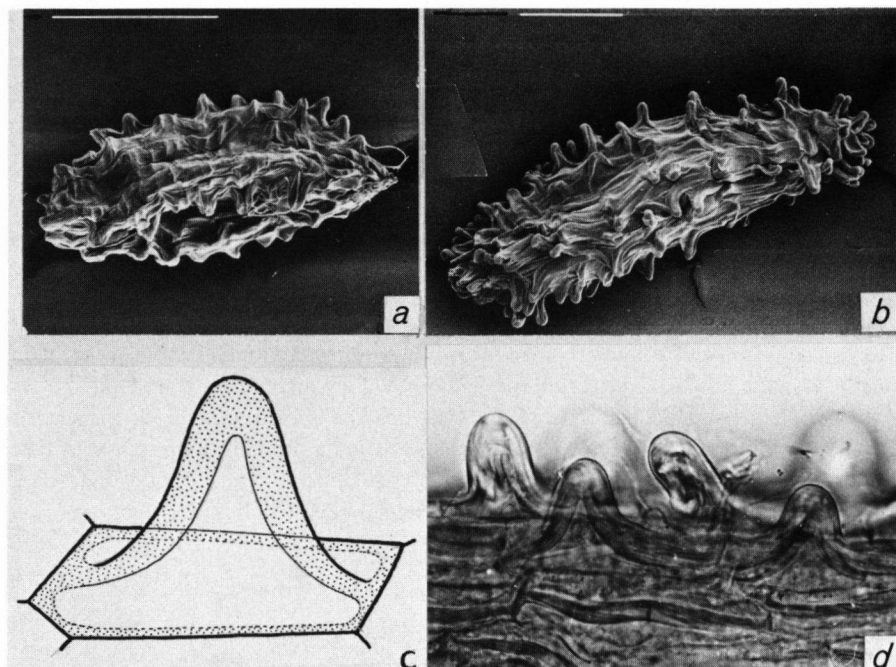


Fig. 3. a. *Didymocarpus antirrhinoides*, SEM-micrograph of seed. — b–d. *D. sulphureus*: b. SEM-micrograph of seed, c. semi-diagrammatical representation of a testa cell forming a tubercle (wall thickenings stippled), d. LM-photograph of surface of a soaked seed. Bar 100 μ m.

special paper on this topic is under preparation), we can state that within sect. *Didymocarpus* a progression from smooth through papillate to tuberculate seeds can be recognized. In *D. albicalyx*, for instance, the surface wall of the testa cell is thin, smooth and plane. In *D. yunnanensis* the walls are sometimes slightly pouched. In *D. macrophylla*, and even more so, in *D. punduanus* and *D. purpureus*, the surface walls grow out into conspicuous papillae. The greatest similarity to the seeds of *Elati* is shown by *D. citrinus*, in which the tubercles arise from thickened wall bands. Such bands are, however, also present in *D. pedicellatus* and *D. stenanthos*, but here without forming protrusions. The longest tubercles are found in *D. cordatus*, an isolated species which cannot be placed satisfactorily in any of the existing sections of *Didymocarpus* (see below).

Chromosome number. — There are now records of chromosome numbers for at least ten species in sect. *Didymocarpus* and sect. *Elati* taken together. Reducing counts to the haploid level, there have been records of $n = 11, 12, 14, 16, 18, 22, 27, 28$ (Ratter, 1975; with the addition of $n = 18$ for *D. pedicellatus* from Vasudevan, 1977).

For sect. *Elati* the records are:

<i>D. antirrhinoides</i>	n = 22	Ratter & Milne, 1970, as <i>D. corchorifolius</i>
<i>D. sulphureus</i>	n = 11	Ratter, unpublished, based on <i>Woods 617</i> , cult. E

D. citrinus also has n = 11 (Ratter & Milne, 1970), but otherwise this base number has not been recorded in sect. *Didymocarpus*, nor elsewhere in the genus.

DISTRIBUTION OF SECTION ELATI

Sect. *Elati* is essentially a group of the Malay Peninsula with *D. corchorifolius* just reaching peninsular Thailand. *D. corchorifolius* is otherwise only known from Pulau Penang, but the allied *D. antirrhinoides* is fairly widely distributed from Perak to Johore, including Pulau Tinggi just off the west coast. This is interesting as the species on Pulau Tioman (no. 3 below) seems to be distinct, though at present too little known to be named. *D. sulphureus* is found on the hills of Perak, Pahang and Selangor and its var. *grandiflorus* is found on Gunong Kerbau, which is also the type locality for *D. robustus*.

NOTES ON SPECIES THAT HAVE BEEN ASSOCIATED WITH SECTION ELATI

The species to be considered are *D. purpureus* and *D. citrinus* (both placed at first by Ridley in sect. *Elati* and subsequently in sect. *Didymocarpus*), *D. violaceus*, *D. lacunosus*, and *D. inaequalis*. In addition, *D. cordatus*, wrongly transferred by Ridley to *Paraboea*, also needs brief mention.

D. purpureus Ridley: This is a true member of *Didymocarpus* sect. *Didymocarpus*, with annual stems, characteristic claret-coloured and shiny calyx and corolla, and stipitate pods opening along both sutures. There are no coloured glands on the leaves. It is found on Pulau Langkawi on quartzitic sandstone.

D. citrinus Ridley is aberrant in sect. *Didymocarpus* in having pure yellow flowers; superficially they show some resemblance to those of *D. sulphureus*, but the details of corolla-shape are different and there are other differences in the calyx (which has thickened margins with conspicuous hydathodes), the anthers (connective enlarged into an almost quadrangular pad), and stigma (not bilobed). The flowers are enantio-stylous, the coherent anthers being turned over to one side (and thus lying on one side), the style and stigma being slightly displaced to the other: the direction in which the shift has been made varies in the individual flowers on one plant. On the underside of the leaves there are yellow-brown glands, but they have two-celled heads (fig. 2b) and thus differ sharply from those of *D. sulphureus*.

D. citrinus should be retained in sect. *Didymocarpus*, because it lacks the tall stature and woody habit, the bilobed stigma and the conoid glands of sect. *Elati*.

Nevertheless, the colour of the flower, the elaboration of the anther connective, the chromosome number $x = 11$ and the seed structure suggest that the resemblance to *D. sulphureus* does represent a real affinity, a conclusion which is reinforced by the fact that *D. citrinus* is endemic on Gunong Jerau (Kedah Peak), which is marginal to the area of *D. sulphureus*.

D. violaceus Ridley: We have seen only the type specimen (Ridley 2909, Perak, Hermitage Hill, 1500 m; BM). Apparently with reference to the subrosulate habit Ridley at first placed it together with *D. lacunosus* (see below) in sect. *Acaules*, but later transferred it to sect. *Didymocarpus*. In this he may have been right, but until better material is available for study nothing more can be said. At any rate, it does not show any affinity to sect. *Elati*.

D. lacunosus Hook. f. is now *Chirita lacunosa* (Hook. f.) B.L. Burtt, Notes Roy. Bot. Gard. Edinb. 26 (1965) 267; Wood, op. cit. 33 (1974) 151. This is the lectotype of sect. *Acaules* (Burtt, 1954: 203) and therefore takes the sectional name out of *Didymocarpus*.

D. inaequalis Ridley is certainly misplaced in sect. *Didymocarpus*. It has somewhat woody stems with spaced, alternate (!) leaves, a large trumpet-shaped corolla, and fruits held \pm horizontally. It seems to have no close allies, but is best regarded at present as a somewhat woody member of sect. *Didymanthus*. This is supported by the seeds having small, solid pustules on the testa walls. It grows with *D. purpureus* on the quartzitic sandstone of Pulau Langkawi.

D. cordatus Jack (see Clarke, 1883: 84, tab. 9). This is a very isolated species, being a coarse herb with large, many-flowered inflorescences arising from the axils of the uppermost leaves. The flowers have short, open (campanulate) corollas of whitish colour, the filaments are short, the massive anthers form a cone with an apical pore (formed between the bases of the two adjacent outer thecae), and the disc is much reduced. These are clearly the characters of an oligandrous pollen flower (see Vogel, 1978). The fruit opens along both sides. On the underside of the leaves, in the sepals and fruit wall there are dark-red sacs. These are nothing like the superficial free glands of sect. *Elati*.

D. cordatus is a well known species, but its position within the genus is uncertain. The mode of fruit dehiscence and the seed structure point to a closer affinity with sect. *Didymocarpus* and sect. *Elati* than with other sections. Ridley (1905) transferred it to *Paraboea*, but it lacks the characteristic indumentum and calciphile habit of that genus, in which it also has no close relatives.

In conclusion, none of the six species annotated here should be included in the emended concept of *Didymocarpus* sect. *Elati*.

TAXONOMIC TREATMENT

Didymocarpus sect. **Elati** Ridley

Didymocarpus sect. *Elati* Ridley, J. Str. Br. Roy. As. Soc. 44 (1905) 28; J. As. Soc. Beng. 74 (2), extra no. (1909) 745.

Plants shrubby, erect to 2 m, or branches slender, flexuous and scrambling; indumentum of deflexed hairs. *Leaves* opposite, unequal, hirsute with uniseriate 3–10-celled hairs, the lower surface also with reddish-brown, very shortly stalked conoid glands. *Inflorescences* axillary, cymose; peduncles straight, patent, or elongate and pendulous; cymes pair-flowered; bracts broadly triangular-subcordate. *Calyx* 5-lobed, the lobes free or united in the lower half, shining, glabrous. *Corolla* broadly tubular and personate, or trumpet-shaped and open at the mouth. *Stamens* 2, filaments adnate to corolla in lower part; anthers cohering face to face; staminodes 3, filiform, the third very small. *Disc* shortly cylindric, lobulate at margin. *Ovary* elongate, cylindric, glandular hairy (sometimes with intermixed conoid glands); style short; stigma bilobed, the upper lobe smaller than the lower. *Capsule* dehiscent loculicidally along both sutures. Seeds ellipsoid, the testa with well-developed tubercles.

KEY TO THE SPECIES

- 1a. Inflorescence with a short (up to 3 cm) straight peduncle; corolla white, pale pink or pale yellow, tube broad throughout, mouth personate 2
- b. Inflorescence with elongate (10–20 cm) pendulous peduncle; corolla bright yellow, tube narrowed to base, mouth open 4
- 2a. Bracts free; calyx divided to base; fruits without cone- or spindle-shaped glands; leaves lanceolate to ovate (c. 2½ times as long as broad) . . . 1. **D. corchorifolius**
- b. Bracts connate towards the base on one side; calyx divided to half-way; fruits with red-brown cone- to spindle-shaped glands, leaves ovate (c. 2 times as long as broad) 3
- 3a. Peduncle 2.5–3 cm, cyme with several (up to 8) flowers . . 2. **D. antirrhinoides**
- b. Peduncle not exceeding 2 cm, almost always 1-flowered; plant with conspicuous lateral shoots (emerging from axils of fallen leaves) with small, densely crowded leaves 3. **D. sp.**
- 4a. Leaves in pairs, unequal (the smaller usually less than half as long as the larger), moderately hairy, coloured rusty-brown below by spindle-shaped glands; axes slender, usually conspicuously zig-zag in upper part and drooping 4. **D. sulphureus**
- b. Leaves in whorls of three, subequal, densely hairy above, with thick felt of woolly hairs below (copper-coloured when dry); axes stout, ± straight 5. **D. robustus**



Fig. 4. *Didymocarpus corchorifolius*. a. type (iso E), b. upper part of Nauen 38066 (BM). Bar 10 cm.

1. *Didymocarpus corchorifolius* DC. — Fig. 4a (type), 4b.

D. corchorifolius Wall. [Cat. (1829) 792; R. Br. in Benn., Pl. Jav. Rar. 2 (1840) 119, *nomen*] ex DC., Prod. 9 (1845) 265; C.B. Clarke in DC., Monogr. Phan. 5 (1883) 85; Burt, Notes Roy. Bot. Gard. Edinb. 21 (1954) 204; Barnett, Fl. Siam. En. 3 (1962) 212. — *Roettlera corchorifolia* (DC.) O. Ktze, Rev. Gen. Pl. 2 (1891) 476. — Type: Porter in Wallich 792 (G-DC, n.v., IDC micro, iso BM, E, G, K, K-W, L, M, WU), Penang.

Shrub; shoots with internodes c. 4–7.5 cm long, densely hairy especially below the nodes; hairs deflexed, semi-patent, uniseriate, of 7–10 cells, cone-shaped glands lacking or sparse. *Leaves* opposite, unequal, the upper ones subtending an inflorescence and also a short flowering brachyblast; plus-leaf 6–10(–15) cm long, petiole

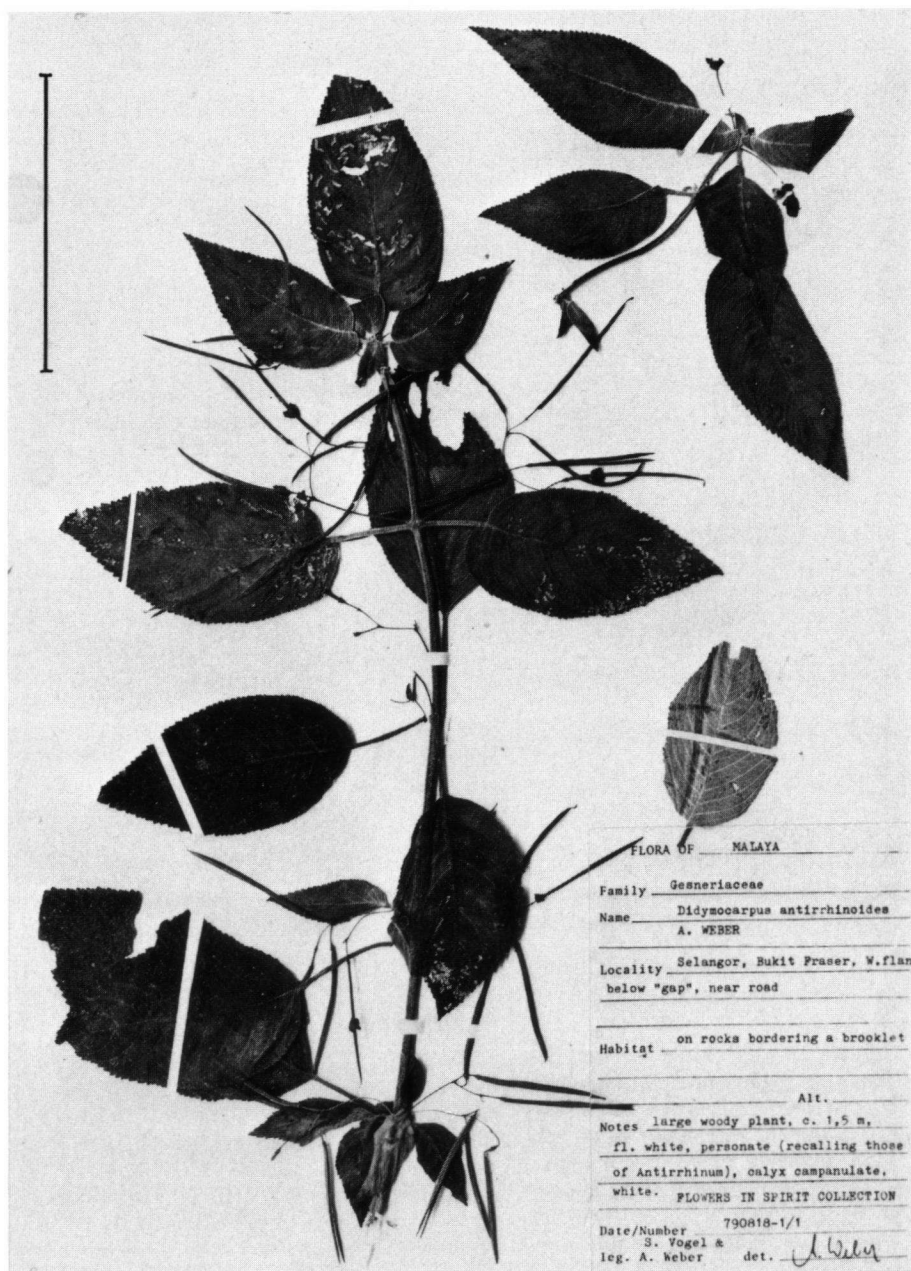


Fig. 5. *Didymocarpus antirrhinoides*, type (holo WU). Bar 10 cm.

1–4 cm, lamina lanceolate to ovate, c. 2.5 times as long as broad, base unequal-sided (one side attenuate-cuneate, the other attenuate to cuneate, rarely truncate), margins crenulate-serrate; hairy above, the hairs 3–6-celled, on underside hairs dense on main and lateral nerves, sparser on veins of reticulum, (sub)glabrous between, cone-shaped glands few and scattered; stomata (in dry leaf) often prominent and looking like a layer of globose glands; minus-leaves about half as long as plus-leaves. *Inflorescences* axillary on main shoot and short axillary branchlets; peduncle 2–3 cm, thinly hairy in the lower part, glabrous above, branches of cymes 1–1.5 cm, pedicels 0.5–1 cm. Bracts broadly triangular-subcordate, free from one another, glabrous (or with a few hairs on the mid-line outside). *Calyx-segments* 5, free to the base, lanceolate, c. 5 mm long, 3–4-nerved, glabrous. *Corolla* 1.5–2 cm; tube broad; lobes of upper and lower lip reflexed, mouth personate. *Stamens* 2, filaments arising about 1/3 up the corolla tube, with short glandular hairs in upper part; anthers cohering face to face. *Disc* shortly cylindric, pubescent with short glandular hairs, cone-shaped glands lacking, style short; stigma bilobed with short upper lobe and large rounded lower lobe. *Fruit* 4–4.5 cm long, dehiscing loculicidally along both sutures.

Distribution: Peninsular Thailand and Pulau Penang.

S. THAILAND. Betong, Pattani, c. 200 m, 8 VIII 1923, Kerr 7506 (BM, K).

MALAYSIA. Penang: Maingay 1227 (BM, K, L); Gerard 79/3; Moniot's Road, 700 m, IX-1887, Curtis 1239 (K, SING); Government Hill, IX 1901, Curtis s.n. (SING); Penang Hill, 700 m, VIII 1920, Nauen s.n. (SING); Waterfall Gardens, 21 X 1921, Burkill 6572 (SING); Penang Hill, 700 m, 20 VIII 1941, Nauen SFN 38066 (A, BM, K, SING).

Notes: We have not seen this plant alive, therefore we do not know precisely whether the corolla mouth is entirely closed as in *D. antirrhinoides*. The notes on the herbarium labels do not indicate a personate condition, but the same holds true for *D. antirrhinoides* and the dry flowers look very likely to form a distinctly raised palate. The only records of flower colour are 'pale pink, greenish-yellow marking in throat' (Nauen SFN 38066) and 'white' (Kerr 7506).

The latter collection, from South Thailand and the only one outside Pulau Penang, needs further mention. In the bract and calyx characters it is clearly *D. corchorifolius*, but the habit is somewhat different from the type in that the leaves are larger and broader and there are not the conspicuous dense-leaved axillary branchlets in the upper part of the plant. In both respects, however, Curtis 1239 from Penang comes close, and therefore we do not give too much weight to this aberrance. A further distinctive feature, however, remains: the leaves are less hairy, but much more densely beset with conoid glands on the undersurface. Further material is required to clarify definitely the taxonomic status of the Thailand plant.

2. *Didymocarpus antirrhinoides* A. Weber, *sp. nov.* — Fig. 5, 6a–h.

D. corchorifolius auct. non DC.: Ridley, J. Str. Br. Roy. As. Soc. 44 (1905) 31; J. As. Soc. Beng. 74, extra no. (1909) 747; Fl. Mal. Pen. 2 (1923) 508 — *omn. quoad descr.*, Henderson, Mal. Wild Flowers 1 (1974) 345.

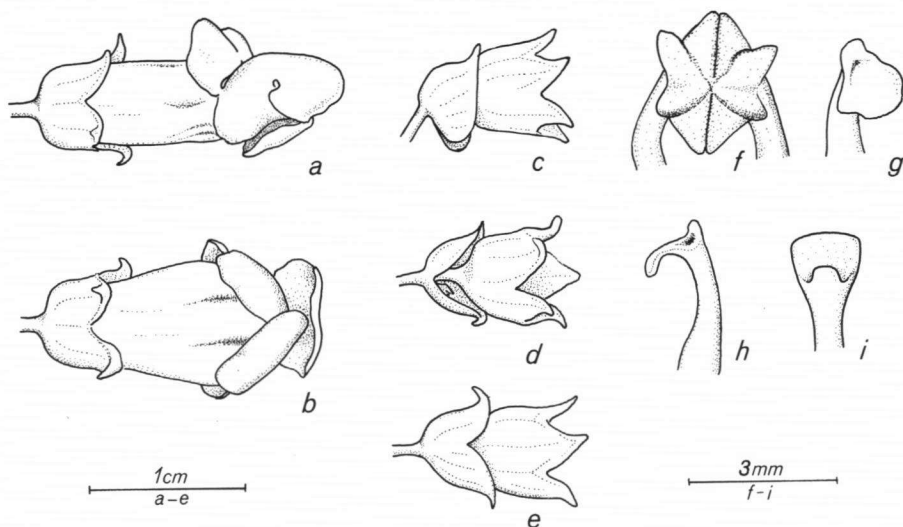


Fig. 6. a-h. *Didymocarpus antirrhinoides*. a, b. flower seen from side and below, c-e. bracts and calyx seen from side, below and above, f. coherent anthers, g, h. stigma from front and side. - i. *D. sulphureus*, stigma from above.

Didymocarpus corchorifolius DC. affinis, sed bracteis unilateraliter connatis, calyce cupulari lobis ad medium tantum liberis, foliis brachyblastis foliiferis et floriferis carentibus differt.

Planta suffruticosa 1-1.5 m alta, ramosa; axes hirsuti e pilis simplicibus acutis 4-5 cellularibus deorsum appressis. *Folia* opposita, 10-15(-20) cm longa, petiolata (petiolo 1-1.5 cm longo), moderate anisophylla; lamina ovata, acuta, basi inaequilaterali (altero dimidio angustato-cuneato, altero truncato vel subcordato); facies superior regulariter hirsuta e pilis acutis 4-5-cellularibus, facies inferior in nervis dense hirsuta, cetera sparsim hirsuta, sed multis glandulis bruneis conoideis cum pilis intermixtis. *Inflorescentiae* axillares, cymosae; pedunculi recti, 2.5-3 cm longi, moderate hirsuti; cyma 3-8-flora, floribus geminatis; bractae subcordatae, in parte inferiore inaequaliter connatae; axes cymae et pedicelli tenues (sub)glabri. *Calyx* 6 mm, cupuliformi-campanulatus, carnosus-cartilagineus, albus, glaber; sepala in dimidio superiore libera, apicibus curvatis. *Corolla* 1.5-2.3 cm longa, alba, tubo lato, fauce personata; limbus bilabiatus, labio superiore 2-lobato, inferiore 3-lobato, lobis omnibus revolutis. *Stamina* 2; filamenta in parte inferiore ad corollam adnata; antherae latae, coram cohaerentes; thecae divaricatae, dorso processu connectivi triangulari-bilobo praeditae, et thecae et processus et pars filamentum superior glandulis conoideis ornata. *Staminodia* 3, tertium minimum. *Discus* breviter cylindricus, margine irregulariter lobatus. *Ovarium* elongatum, cylindricum, hirsutum e pilis glandulosis et glandulis conoideis; stylus brevis; stigma bilobum, lobo superiore brevissimo, lobo inferiore discoideo. *Capsula* elongata, 4-4.5 cm longa, bivalvis; valvae glandulis conoideis obsitae. Semina ellipsoidea, testa tuberculata. - *Typus*: Vogel & Weber 790818-1/1 (WU), Malaysia, Selangor, Bukit Fraser, W. flank.

Distribution: Nearly throughout the Malay Peninsula, in hill forest.

MALAYSIA. Perak: s. loc. et dat., Scortechini s.n. (SING); Kinta, 500-700 m, I 1886, King's coll. 7220 (SING); Bujong Melaka, 1891, Ridley s.n. (SING); ibid. 300-500 m, XII 1895, Curtis 3130 (SING); ibid., Jong, cult. R.B.G. Edinb. C. 5168 (F); Jor, 18 X 1924, Haniff SFN

10317 (SING); Keledang Sarong F.R., 21 II 1934, Sow KEP 33724 (KEP). — Selangor: Bukit Fraser (type); Pahang Path (Semangko Pass), 800–1000 m, IX 1886, King's coll. 10998 (A, SING); Pahang Track, 15th mile, VII 1897, Ridley 8553 (K, SING). — Negri Sembilan: Ulu Pedas, 700 m, 26 XI 1923, Nur SFN 11735 (SING); Ulu Bendol, 30 XI 1922, Holtum SFN 9818 (K, SING). — Johore: Sungai Pulai dua, 25 IV 1922, Nur & Kiah SFN 7747 (SING); Pulau Tinggi, 700 m, 17 VI 1952, Strugnell KEP 70932 (KEP).

Notes: The description under *D. corchorifolius* given by Ridley in all his publications refers to this plant; he failed to notice that C.B. Clarke described the calyx of *D. corchorifolius* as being divided to the base, with which his own description 'calyx cup-shaped 5-toothed' clearly disagrees.

Flower colour is apparently somewhat variable in this species: it is recorded as 'white' (KEP 70932), 'very white bright yellow inside' (King's coll. 10998), 'waxy white pale green inside' (King's coll. 7220), 'pale pink' (Haniff SFN 10317) or 'pale yellow' (Nur & Kiah SFN 7747). The plant cultivated at Edinburgh (C. 5168 from Bujong Melaka) is white distinctly suffused yellowish-green on the palate.

3. *Didymocarpus* sp.

Plant suffruticose, branched, up to 1 m high; axes hirsute with simple acute 5–6-celled hairs, appressed downwards. *Leaves* on the main axes 8–10 cm long, soon falling, subtending a usually single-flowered peduncle and below that a short axillary branchlet; leaves of the branchlets elliptic, c. 2–5 by c. 1.5 cm, densely appressed pubescent above, shortly hirsute especially in the nerves below, and with purple-black conoid glands, margins closely serrate; petioles densely hirsute, 3–5 mm long. Peduncles up to 2.5 cm long, sparingly hirsute towards the base, glabrous above. Bracts c. 2 mm long, united in the middle on one side, glabrous. Pedicels c. 5 mm, glabrous. *Calyx* divided to the middle into 5 triangular lobes. *Corolla* pale yellow (ex Nur). Capsule (juvenile) 3–3.5 cm long, shortly and sparsely pubescent with purple-black glands intermixed.

MALAYSIA. Pahang: Pulau Tioman, Gunung Rokem, 810 m, 13 V 1927, Henderson SFN 18393 (K, SING); *ibid.*, 750 m, 1 V 1927, Nur SFN 18785 (SING).

Notes: This species has the vegetative features of *D. corchorifolius* (see notes under 'habit') combined with the floral characters of *D. antirrhinoides*, but is distinguished by its shortish, usually 1-flowered peduncles. Further material is required to confirm that this plant really is a distinct species before giving it a name.

4. *Didymocarpus sulphureus* Ridley — Fig. 7.

D. sulphureus Ridley, J. Str. Br. Roy. As. Soc. 44 (1905) 32; J. As. Soc. Beng. 74, extra no. (1909) 747; Fl. Mal. Pen. 2 (1923) 509. — Lectotype: King's coll. 8059 (SING), Perak, Gunung Batu Puteh, 1000–1300 m, VIII 1885.



Fig. 7. *Didymocarpus sulphureus*. a. upper part of a shoot, b. inflorescence, flowers about nat. size. Photos taken by A.W. on G. Brinchang, Pahang, Malaysia.

a. var. *sulphureus*

Woody sprawling and ascending plant, branches 2–3 m long, slender, upper parts bent over and growing downwards, axes often zig-zag. *Leaves* of a pair very unequal; plus-leaf with petiole 1–2 cm, lamina 6–12 cm, broadly lanceolate to ovate, acute, unequal at base, margins serrate; minus-leaf similar in shape, usually less than half as long; upper side of lamina green, loosely hairy, lower side often purple to rusty brown, densely hairy especially along the nerves, areas between veins beset with numerous cone-shaped to rod-like brown glands. *Peduncle* filiform, up to 20 cm long, sparsely hairy, pendulous. Cyme 6–12-flowered, flowers in pairs; bracts broadly triangular to rounded, free, glabrous; cyme axes and pedicels glabrous. *Calyx* c. 6 mm long, divided to the base, segments lanceolate, tips recurved, glabrous polished, green or purple. *Corolla* yellow, up to 4 cm long, tube slightly constricted in lower third, then gradually widening upwards; lobes of upper lip erect, of lower lip porrect or slightly declined. *Stamens* 2, filaments arising just below the middle of the corolla tube, glabrous below with some stalked glandular hairs near the top; anthers cohering face to face, the connective forming a swollen oblong pad where it joins the filament.

Disc cylindric, lobulate. Ovary cylindric, with short eglandular spreading hairs and globose to cone-shaped pigmented glands intermixed. Stigma bilobed, the upper lobe smaller than the lower. *Capsule* 6–6.5 cm long, beset with brown globular to cone-shaped glands. Seeds narrowly ellipsoid, the testa produced into well developed tubercles.

Distribution: Malay Peninsula, on the hills of the main range in Perak and Pahang.

MALAYSIA. Perak: G. Chabang, VIII 1884, Scortechini s.n. (K); G. Ijok, VIII 1884, Scortechini s.n. (SING); Bujong Melaka, Ridley 9774 (SING); G. Batu Puteh, 1500 m, Wray 219 (SING). – Pahang: Cameron Highlands, G. Brinchang: 2000 m, Abbe et al. 9768 (A); 1850 m, Poore 10266 (KLU); 2000 m, KLU 8015 (L, SING); 2000 m, van Balgooy 2664 (E); 2000 m, Vogel & Weber 790819–1/1 (WU); Kiew 1036 (UPM); Robinson Falls: 1600 m, Burkill 745 (A, K, L, SING); Woods 617 (E); 1400 m, van Balgooy 2639 (E); G. Berembun: 2000 m, Ridley 13598 (BM, K, SING); 2000 m, Henderson SFN 11092 (SING); 2000 m, Chew 786 (A, B, G, K, L, SING); 2000 m, Ogata KEP 110303 (L); 2000 m, Whitmore FRI 15494 (SING); Foot of G. Terbakar: 1050 m, Holttum SFN 31383 (A, K, SING). Guroh Pass: Forest Dept. 27605 (SING), KEP 15 (SING).

b. var. breviflorus Ridley

D. sulphureus Ridley var. *breviflorus* Ridley, J. Str. Br. Roy. As. Soc. 44 (1905) 32; J. As. Soc. Beng. 74, extra no. (1909) 747; Fl. Mal. Pen. 2 (1923) 509. – Type: *Ridley 7582* (SING), Selangor, Bukit Kutu, VI 1891.

‘Bracts and sepals narrower, acute, pubescent. Corolla smaller, 1/4 in. long. Capsule pubescent, 3/4 in. long’ (Ridley).

MALAYSIA. Selangor (type). – Perak: Keledang Sarong F.R., KEP 25410 (KEP), KEP 25884 (KEP).

c. var. grandiflorus Ridley

D. sulphureus Ridley var. *grandiflorus* Ridley, Fl. Mal. Pen. 2 (1923) 509. – Type: *Robinson* (BM, K, SING), Perak, Gunung Kerbau, 1800 m, 18 III 1913.

‘Sepals broad lanceolate, acuminate. Corolla much larger, 1.75 in. long, 0.5 in. wide. Leaves less hairy’ (Ridley).

Distribution: Known only from the type locality.

Notes: *Didymocarpus sulphureus* is a very distinctive species most easily recognized by its straggling and climbing habit, the upper parts of the long, slender branches drooping from the supporting plant. It is conspicuously anisophyllous and the bunches of lemon yellow flowers hang down on long peduncles (fig. 7). As in many other strongly anisophyllous gesneriads, the inflorescences arise exclusively in the axils of the plus-leaves. In cultivation, however, small pot-grown plants may have the two leaves of a pair almost equal in size and then both may produce axillary inflorescences.

The var. *breviflorus* is little known and needs further study; it may well prove to be a distinct species. The var. *grandiflorus* is from G. Kerbau, the type locality of *D. robustus* (see note under that species).

5. *Didymocarpus robustus* Ridley

D. robustus Ridley, J. Fed. Mal. St. Mus. 6 (1915) 52; Fl. Mal. Pen. 2 (1923) 508. – Type: *Robinson's collectors s.n.* (BM, K, SING), Malaysia, Perak, Gunung Kerbau, 1800–1980 m, 12 & 18 III 1914.

Tall woody plant, in habit probably similar to *D. sulphureus*, but axis stouter; internodes 6–10 cm, densely hairy with reflexed appressed hairs. *Leaves* (always?) in whorls of three*, somewhat unequal in size; petiole short, c. 0.5 cm; lamina 4–6 cm, ovate, usually not more than twice as long as broad, acute, unequal-sided at base; indumentum extremely dense on both sides, on the underside appearing as a thick woolly (drying copper-coloured) fur; cone-shaped glands present, but completely covered by hairs. *Peduncles* 10–17 cm long, more or less densely hairy. Bracts glabrous (the lowest pairs sometimes hairy outside), broadly triangular, free. Cyme with several to many flowers, pendulous; axes 1.5–2 cm, glabrous, pedicels 0.8–1 cm, glabrous. *Calyx* funnel-shaped; segments connate in lower quarter, broadly lanceolate, mostly 1-nerved. *Corolla* c. 2 cm long, yellow; shape, as well as stamens, disc and ovary as in *D. sulphureus*. Stigma bilobed, upper lobe small rounded, lower lobe enlarged, rounded, sometimes with a slight notch at the tip. *Fruit* 3.5 cm, with short and scattered eglandular hairs and brown, cone-shaped or globular glands.

Notes: This species is known only from the type specimens, which are usually attributed to Robinson's own collecting. Robinson had been on the mountain in 1913, when he collected *D. sulphureus* var. *grandiflorus*; but the next year it was the Dyak collectors who worked for the Federated Malay States Museum who did the collecting. Apparently *D. robustus* was found twice, on 12 and 18 March, at 6000 and 6600 ft. Ridley does not cite the dates of collection (these are taken from the herbarium sheets) and merely gives the altitudinal range.

D. robustus is clearly very closely allied to *D. sulphureus*, distinguishable by the stouter non-flexuous axes and the smaller, extremely densely hairy leaves. Whether the whorled leaves provide a constant character is not known as the whorled condition occurs frequently in normally decussate plants. Field work is obviously needed to find out the relation between this plant and *D. sulphureus* var. *grandiflorus*, as they are found on the same mountain.

* Ridley wrote '4 or more in a whorl', but apparently mistook leaves of young axillary shoots for whorl-leaves.

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